

Another object of the present invention is to provide such a bracelet assembly for detecting cracks and other possible flaws near a dimensional change of a pipe.

Another object of the present invention is to provide such a bracelet assembly,
5 which is versatile and which can be used for other types of operations on a pipe.

According to the present invention, there is provided a bracelet assembly for moving sensor modules around a pipe, comprising:

10 a frame adapted for installation around the pipe, the frame having a circular shape and a pair of circular members spaced apart from each other;

supports adapted to receive the sensor modules;

15 a sliding arrangement slideably mounted onto the frame and guiding a displacement of the supports in periphery of the pipe, the sliding arrangement comprising attachments spaced apart from one another and receiving the supports in periphery of the pipe, the sliding arrangement comprising a slideable member to which the supports are attached, and a
20 guide member extending on the frame and slideably receiving the slideable member for sliding along a predetermined sliding range of the peripheral course, the guide member being provided on one of the circular members, the slideable member having an arc shape and extending between the circular members, one of the guide member and the slideable member having elongated grooves extending concentrically with respect to the peripheral course, the other of the guide member and the slideable member having pins engaging in the grooves;

25 a first driving means for controllably driving the sliding arrangement and thereby displacing the supports in periphery of the pipe at desired operating positions;

biasing means for biasing the sensor modules against the pipe;

30 wheel arrangements distributed around the frame and projecting therefrom for engagement with the pipe and displacement of the frame along an axial direction of the pipe; and

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a second driving means for controllably driving the wheels in rotation and thereby displacing the frame along the axial direction of the pipe at a desired operating position.

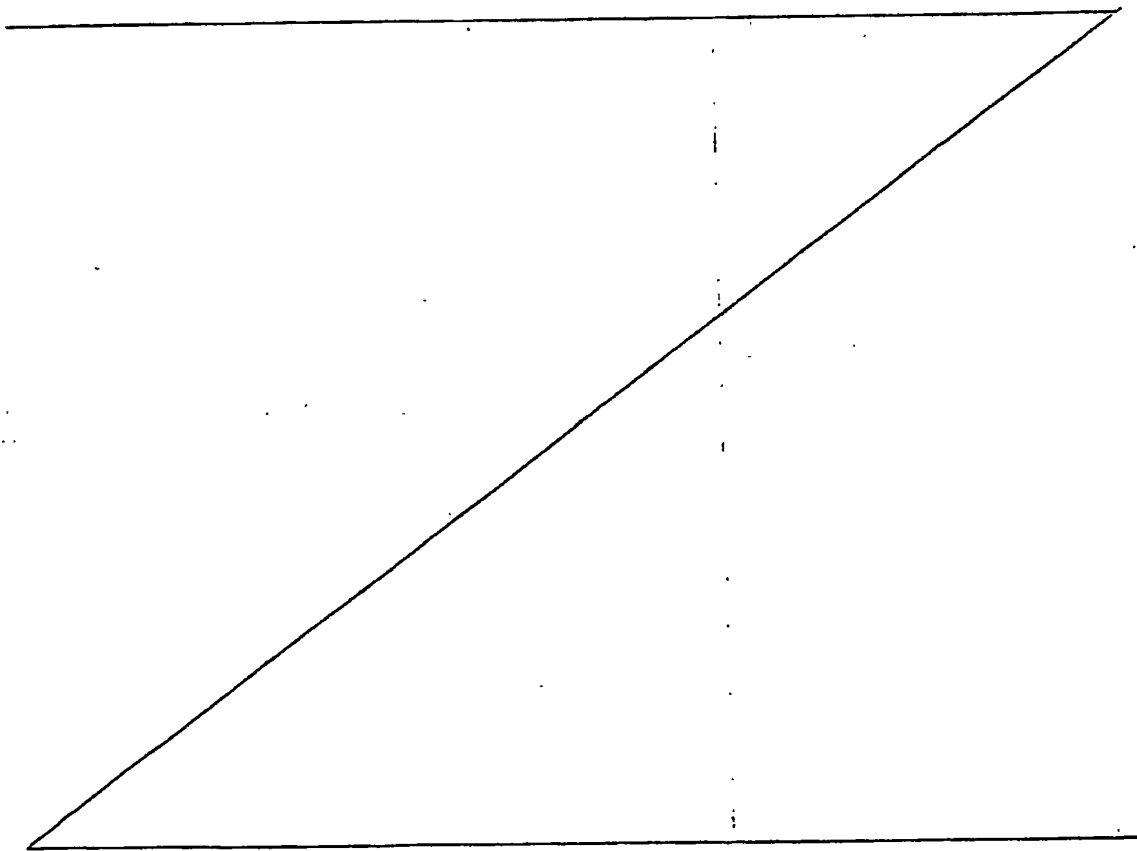
5 BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will become apparent upon reading the detailed description and upon referring to the drawings in which:

Figure 1 is a perspective view of a bracelet assembly with inside sensor modules according to the present invention.

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Figure 2 is a perspective view of a sliding arrangement of a bracelet assembly according to the present invention.

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hold the bracelet around the pipe). Preferably, the shape of the frame 6 adapts to the shape of the pipes, especially at the level of an elbow section of the pipe where the pipe may have an oval shape.

- 5 A sliding arrangement 12 (better shown in Figure 2) is mounted onto the frame 6 for slideably guiding supports 16 along a peripheral course 20 around the pipe. The slidings arrangement 16 has attachments 25 spaced apart from one another and receiving the supports 16 in periphery of the pipe. As illustrated, the sliding arrangement 12 has a slideable member 18 having a pair of curved arms 22,24, so that to the slideable member 18 exhibits an arc of a hoop shape. The curved arms 22,24 are spaced from one another and extend between the circular members 8,10 of the frame 6.

- 15 Pins 34 projecting from each ends of the curved arms 22,24 engage in grooves 36 extending concentrically with respect to the peripheral course 20 on opposite facing sides of the circular members 8,10. The grooves 36 are used as a guide member receiving the slideable member 18 for sliding along a predetermined sliding range of the peripheral course 20. A projecting flange (not shown) extending concentrically with respect to the peripheral course 20 on each of the curved arms 22,24 may also be used instead of the pins 34 to engage the grooves 36.

- 25 It is worth noting that the pins 34 may instead be located on the circular members 8,10 and the grooves 36 may be located along a length of the curved arms 22,24.

- As illustrated in Figure 3, sensor modules 26 are supported by a pair of arms 28,30 connected to a common pivot point, such as formed by an elongated connecting rod extending transversally between the curved arms 22,24 and providing the pins 34.

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To insure that the sensor modules 26 stay in contact with the peripheral surface of the pipe, the wedges 42 of a same pair of sensor modules 26 are linked together by a return spring element 56 located at a lower level than the connecting rod, thereby pushing the wedges 42 against the peripheral surface of the pipe.

Referring to Figure 4, there is shown a bracelet assembly 2 in which the supports 16 are in the form of reciprocating arrangements guided by the sliding arrangement 12 (shown in Figure 2) for oscillation along the peripheral course 20. In the illustrated case, the first driving device has rotating shafts 58 mounted on the frame 6 and linked together, e.g. with a linking belt (not shown). The supports 16 have ends provided with connecting rods 60,62 pivotably attached to the rotating shafts 58. The rotary shafts 58 produce reciprocating motions of the supports 16, as required for crack detection.

Referring to Figures 5 and 6, there is shown another bracelet assembly 2 according to the present invention, which is particularly adapted for inspection near a weld or other dimensional change in the pipe. In this bracelet assembly 2, the slideable member 18 extends on a guide member 19 (shown in Figure 6) mounted on a front side of the frame 6 around the pipe. The slideable member 18 preferably exhibits an arc of a hoop shape. One support 16 is mounted at each end of the slideable member 18 and extends away from the front side of the frame 6. The sensor modules 26 may be located at an angle of 180 degrees from each other. According to the configuration of the sliding arrangement 12 (shown in Figure 2), the slideable member 18 can rotate 180 degrees around the pipe to allow the sensor modules to cover all the circumference of the pipe. It is worth noting that the bottom surfaces 52 (shown in Figure 3) of the wedges 42 (shown in Figure 3) are contoured to match the peripheral surface of the pipe.

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As previously mentioned, the bracelet assembly shown in Figures 5 and 6 is suitable for detection near a weld since the sensor modules 26 are extending away from the frame 6 and not between the frame 6, as shown in Figure 1. The sensor modules 26 (shown in Figure 3) may thus be positioned closer to the feature to inspect.

The supports 16 may be mounted at different positions along the length of the slideable member 18. Mounting brackets 60 may be used to fasten the supports 16 to receiving surfaces 62 extending along the length of the slideable member 18. As shown in Figures 7 to 9, the receiving surfaces 62 may also project from a front side of the slideable member 18. The mounting brackets 60 may be fastened to the receiving surfaces 62 by screws or other kinds of fasteners if desired.

Referring to Figures 7 to 9, various types of supports may be used with the bracelet assembly shown in Figures 5 and 6. For example, these supports may comprise a pair of arms 70 pivotally mounted to the mounting brackets 60. The sensor modules 26 extend between the pair of arms 70. Instead of using return spring element 56 to bias the wedges 42 against the surface of the pipe, torsion springs 72 extend between the mounting brackets 60 and the pair of arms 70 to keep the wedges 42 against the surface of the pipe. As illustrated, the supports 26 may be adapted to direct the ultrasonic beams 48 in different directions within the wall 50 of the pipe to detect axial and/or circumferential cracks. Of course, any other suitable combination of these supports 16 may also be used.

In all the illustrated bracelet assemblies 2, the frame 6 is provided with wheel arrangements 90 distributed around the frame 6 and projecting therefrom for engagement with the pipe and displacement of the frame 6 along the axial direction of the pipe. The wheel arrangements 90 may be as the ones described in the international patent application no. WO 2004/063660 (Lavoie).